



New records of Pectinariidae (Polychaeta) from Lizard Island, Great Barrier Reef, Australia and the description of two new species

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Abstract

Five species of Pectinariidae have previously been reported from Australia. This study documents the first records of this family from the Lizard Island region: *Pectinaria antipoda* is recorded, in addition to its already currently wide Australian distribution; two new species, *Amphictene lizardensis* n. sp. and *Pectinaria carnosus* n. sp. were also discovered and described. A key to all Australian species of Pectinariidae is provided.

Key words: key to species, morphology, Queensland, marine worms, new species

Introduction

Pectinariidae is a family of polychaetes characterized by their diagnostic ice-cream cone shaped sandy tubes and the presence of prominent chaetae, known as paleae, on the first segment. Despite previous confusions and disagreements (Hartman 1941; Day 1967; Fauchald 1977; Holthe 1986), it is currently accepted that the family consists of five genera (Hutchings & Peart 2002; Sun & Qiu 2012).

Pectinariids are poorly known from tropical Australian waters. Hutchings & Peart (2002) undertook a review of Pectinariidae in Australia and recognized the presence of five species belonging to two genera *Amphictene* Lamarck, 1818 and *Pectinaria* Savigny in Lamarck, 1818. *Amphictene* can be identified by both the rim of the cephalic veil and the raised dorsal opercular rim, both cirrate, whereas *Pectinaria* can be identified by the following combination of characters: cephalic veil with numerous long cirri, raised smooth opercular rim, and neurochaetal uncini having major teeth arranged in two or three (or more) rows. The five species of pectinariids occurring in Australia, *Amphictene favona* Hutchings & Peart, 2002, *Amphictene uniloba* Hutchings & Peart, 2002, *Pectinaria antipoda* Schmarda, 1861, *Pectinaria dodeka* Hutchings & Peart, 2002 and *Pectinaria kanabinos* Hutchings & Peart, 2002 have all been recorded from Queensland (Hutchings & Peart 2002), although not from the Lizard Island region.

During the Polychaete taxonomic workshop held at Lizard Island from 12th to 26th August 2013, extensive collections of polychaetes were made around the island and nearby areas. In addition, materials were collected by Australian Museum staff during the CReefs expeditions undertaken from 2008 to 2010. CReefs was the Australian node of the Census of Marine Life, and three coral reef areas were sampled intensively for polychaetes, including Lizard Island over 3 years (2008–2010). Representatives of Pectinariidae collected during these expeditions are included in this paper.

Material and methods

Specimens were collected by hand during the 2013 Lizard Island Polychaete Workshop and the 2010 CReefs Project, and fixed in formalin (7%) or ethanol (70% or 95%).

Specimens were photographed with Spot Flex CCD 15.2 camera fitted on a Leica MZ16 dissection

microscope. Some specimens were stained with methyl green for visual enhancement. Helicon Focus 5.3 Pro software was used to create completely focused images by integrating the layers of partially focused images captured. Some chaetae were removed from specimen and mounted on slides for photographing with Spot Flex CCD 15.2 camera fitted on an Olympus BX50 compound microscope. Selected specimen was critical point dried, gold coated and examined under a Zeiss EVO LS15 Scanning Electron Microscope (SEM).

Full descriptions were made on new species. Measurements (in mm) were recorded for: total length of animal, anterior width (at segment 3) and posterior width (at last chaetigerous segment). Character variations amongst holotype and paratypes of new species were noted and included in brackets in their descriptions.

Station data and figures showing site locations for material collected during the Polychaete workshop are provided as in Ribas & Hutchings (2015, *Zootaxa* 4019). For material collected during CReefs full locality data is provided in Material examined section. Number of specimens under each registration number is one unless otherwise specified. All material has been deposited at the Australian Museum (AM), Sydney. Collecting during the workshop was under permit number G12/35718.1 issued by the Great Barrier Reef Marine Park Authority.

Taxonomic results

Key to genera and Australian species of Pectinariidae (after Hutchings & Peart 2002)

- | | | |
|--------|--|--------------------------------------|
| 1. | Opercular rim cirrate | <i>Amphictene</i> 5 |
| – | Opercular rim smooth | 2 |
| 2. (1) | Cephalic veil smooth | <i>Petta</i> * |
| – | Cephalic veil cirrate | 3 |
| 3. (2) | Cephalic veil laterally attached | <i>Lagis</i> * |
| – | Cephalic veil free | 4 |
| 4. (3) | Major teeth of uncini in 1 row | <i>Cistenides</i> * |
| – | Major teeth of uncini in 2 rows | <i>Pectinaria</i> 7 |
| 5. (1) | Posterodorsal lobe on segment 2 present | <i>Amphictene favona</i> |
| – | Posterodorsal lobe on segment 2 absent | 6 |
| 6. (5) | Scaphal hooks fine | <i>Amphictene uniloba</i> |
| – | Scaphal hooks robust or broad based, with curved pointed tips | <i>Amphictene lizardensis</i> n. sp. |
| 7. (4) | Anteroventral lobe of chaetiger 2 with continuous large rounded papillae | <i>Pectinaria antipoda</i> |
| – | Anteroventral lobe of chaetiger 2 smooth or slightly incised | 8 |
| 8. (7) | Paleae stout with blunt tips | <i>Pectinaria carnosus</i> n. sp. |
| – | Paleae acute to subacute | 9 |
| 9. (8) | Cephalic veil with 10–16 cirri, paleae tips compact | <i>Pectinaria dodeka</i> |
| – | Cephalic veil with 16–28 cirri, paleae tips extended | <i>Pectinaria kanabinos</i> |

*Genera not currently recorded from Australian waters

Genus *Amphictene* Lamarck, 1818

Amphictene Lamarck, 1818: 89.—Fauchald 1977: 120.

Pectinaria (*Amphictene*).—Holthe, 1986: 22.

Type-species. *Amphitrite auricoma* Müller, 1776; subsequent designation by Hartman (1959).

Diagnosis. (modified after Hutchings & Peart 2002). Rim of cephalic veil with numerous long cirri. Cephalic veil completely free from operculum forming dorsal semi-circle around numerous buccal tentacles. Raised opercular margin cirrate. Chaetigers 1–3 (segments 5–7) with notopodia and notochaetae only, chaetigers 4–16 biramous with notopodia, neuropodia, notochaetae and neurochaetae, chaetiger 17 with notopodia and notochaetae only (ratio of number of pairs of notopodia to neuropodia 17/13). Notochaetae with hirsute surfaces or with serrated margins. Neurochaetal uncini with major teeth arranged in 2–6 rows. Posterior 5 segments fused to form flattened plate or scaphe distinctly separate from the abdomen.

Remarks. Thirteen species of *Amphictene* have been described to date. An additional species is described in this paper.

Amphictene lizardensis n. sp.

(Figs 1–3)

Material examined. Holotype: AM W.47432, MI QLD 2194, Lizard Island, Watson's Bay, 14°39'26"S 145°27'3"E, 6.5 m, coll. P. Hutchings & M. Capa, 28 Aug 2010, CReefs, gravid with coelomic gametes, 5.7 mm long, 1.6 mm wide anteriorly, 0.7 mm wide posteriorly. Paratypes: AM W.47429, MI QLD 2194 (2, 1 gravid with coelomic gametes), same locality as holotype, 3.1–4.5 mm long, 1.2–1.5 mm wide anteriorly, 0.8 mm wide posteriorly; AM W.47433, MI QLD 2194, same, 2.8 mm long, 1.2 mm wide anteriorly, 0.6 mm wide posteriorly, mounted for SEM.

Description. Preserved specimen pale cream in colour, small, conical in shape (Fig. 1A–B). Tube composed of cemented sand grains and shell fragments.

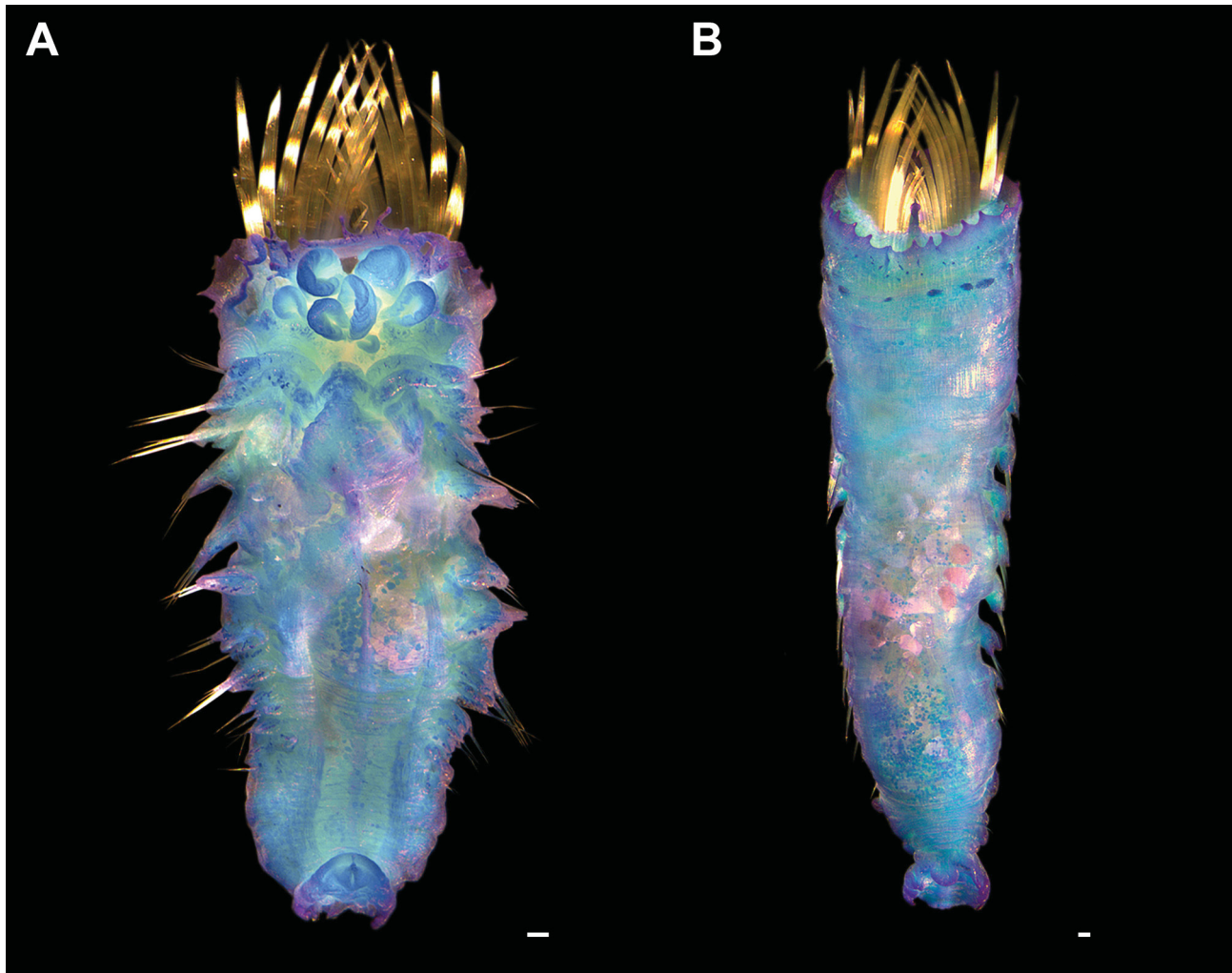


FIGURE 1. *Amphictene lizardensis* n. sp., stained with methyl green. A. Ventral view of entire animal, paratype, AM W.47429; B. Dorsal view of entire animal, holotype, AM W.47432. Scale bars: A–B = 0.1 mm.

Rim of cephalic veil with 11 (10–13) long, narrow cirri, tips rounded and slightly expanded. Cephalic veil completely free from operculum forming dorsal semi-circle around the numerous buccal tentacles (Fig. 2A). Buccal tentacles conspicuous, markedly wide and deeply grooved, inverted V shaped (Figs 1A, 2A). Raised opercular margin well developed, divided into 15 (13–19) triangular lappets. Operculum with 14 (13–14) pairs of long paleae, yellow-gold, curved dorsally, thick at base and flatten towards distal end, tips extended (Fig. 2B), filiform when viewed under SEM (Fig. 3A). A stalked spherical structure was noted between the two sets of paleae, resembling a balloon (Figs 2B, 3A). Length of the structure approximately half of immediately neighbouring (shortest) paleae.

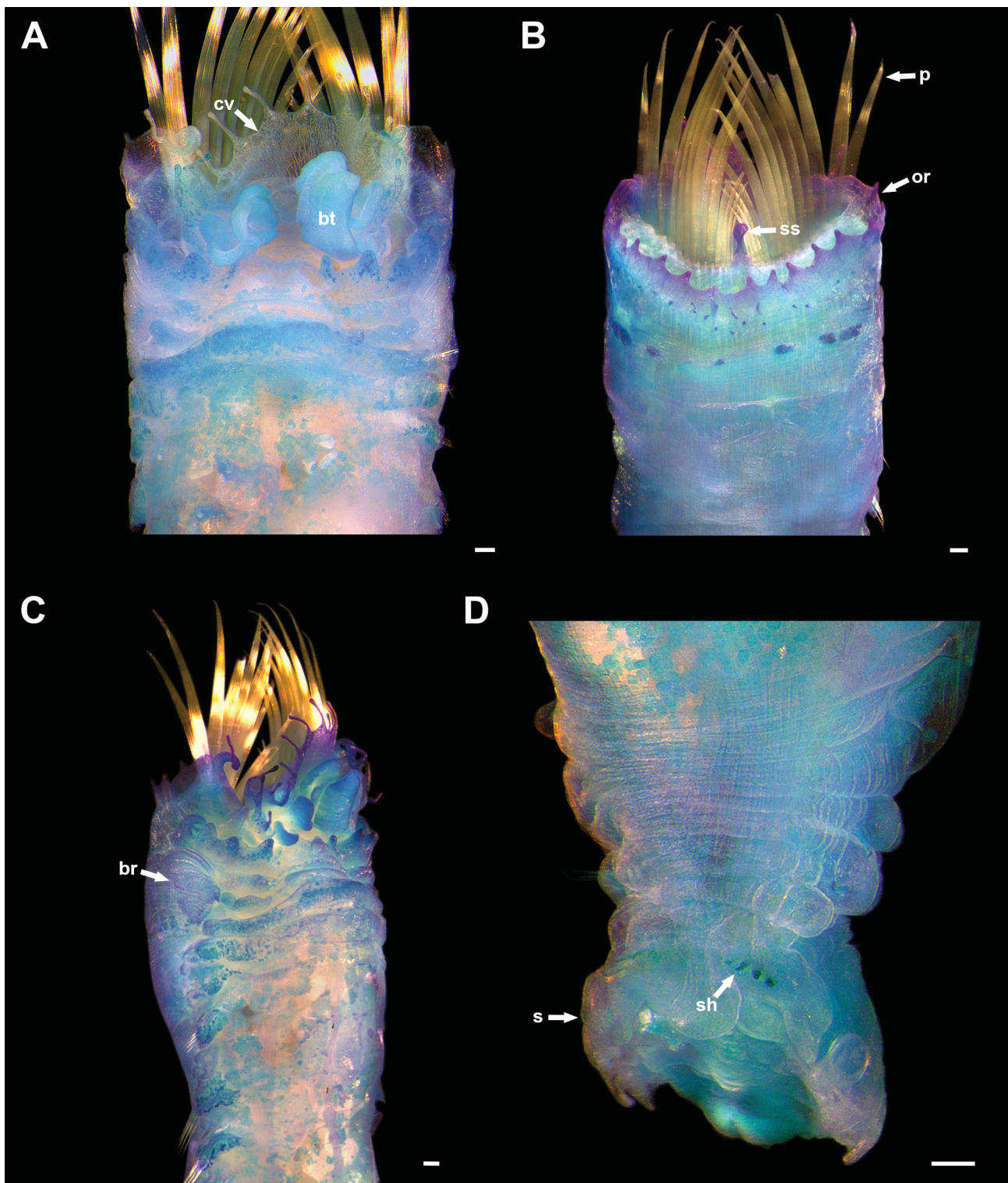


FIGURE 2. *Amphictene lizardensis* n. sp., stained with methyl green, holotype, AM W.47432. A. Ventral view of anterior end; B. Dorsal view of anterior end; C. Lateral view of anterior end; D. Dorsal view of posterior end. Abbreviations: br = branchiae, bt = buccal tentacles, cv = cephalic veil, or = opercular rim, p = paleae, s = scaphe, sh = scaphal hooks, ss = unknown spherical structure. Scale bars: A–D = 0.1 mm.

Tentacular cirri arise on anterior margin of segment 2. Segment 2 without anterodorsal lobe. Two pairs of comb-like branchiae on segments 3 and 4, situated laterally and consisting of loose flat lamellae (Figs 2C, 3B). Anterior pair situated more ventrally and almost twice as large as posterior pair.

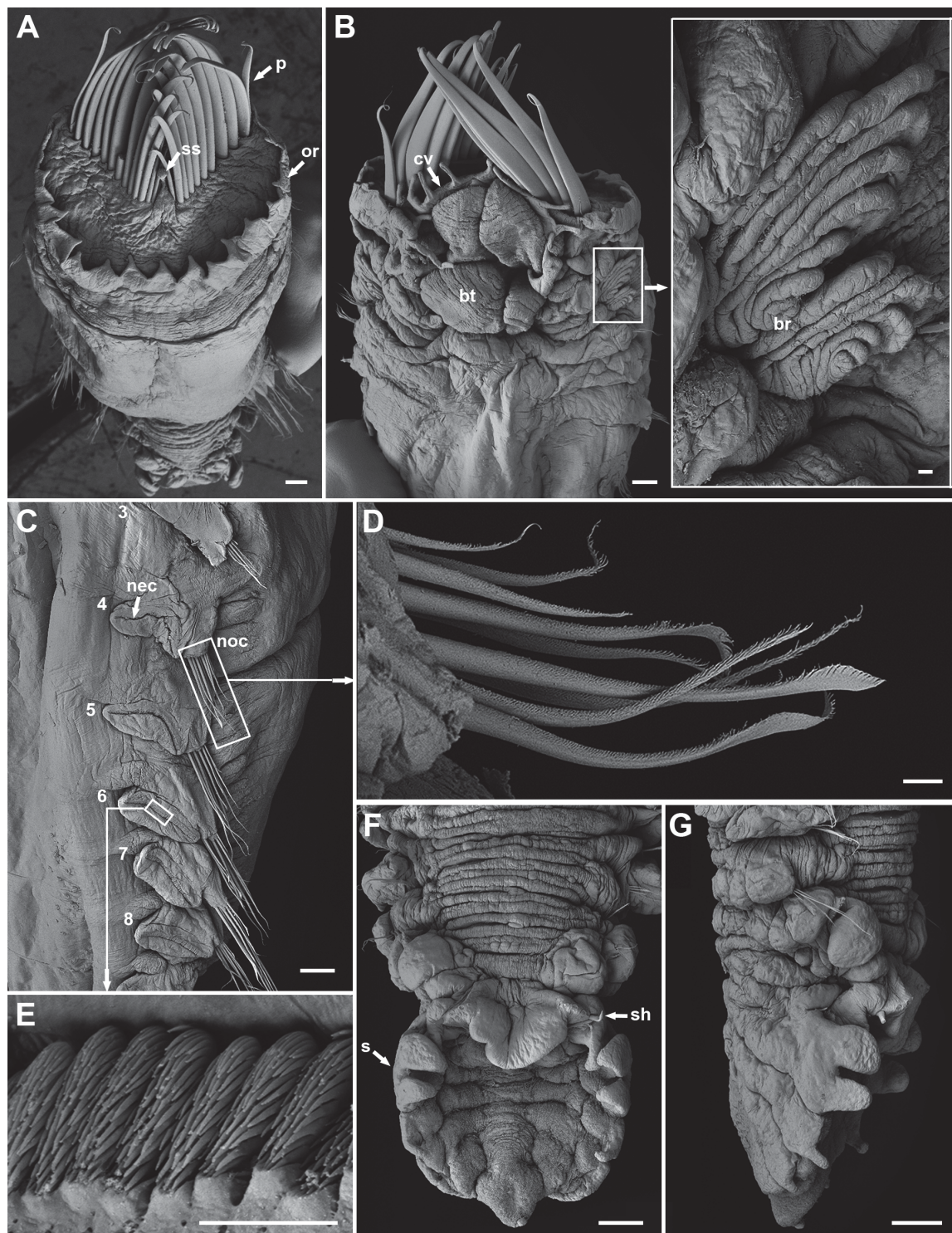


FIGURE 3. SEM images of *Amphictene lizardensis* n. sp., paratype, AM W.47433. A. Antero-dorsal view, opercular rim with triangular lappets, characteristic of *Amphictene* species, paleae thick, distally curved and extended to form filiform tips; B. Ventral view of anterior end of specimen, buccal tentacles conspicuous and markedly wide, two pairs of branchiae inserted laterally on segments 3 and 4, consisting of loose flat lamellae, chaetae commence from segment 5; C. Ventro-lateral view of specimen, neuropodia with neurochaetae commencing from chaetiger 4; D. Notochaetae of chaetiger 4 finely hirsute, some with smooth tip capillaries and some with broad distal pectinate wings; E. Neurochaetae of thoracic chaetiger, uncini arranged in 3–6 longitudinal rows, each row with 6–9 teeth; F. Dorsal view of posterior end, scaphe as broad as long, scaphal hooks broad based with pointed tips, most pairs are lost in this specimen; G. Lateral view of posterior end, scaphal margin crenulated forming lobes. Abbreviations: br = branchiae, bt = buccal tentacles, cv = cephalic veil, nec = neurochaetae, noc = notochoetae, or = opercular rim, p = paleae, s = scaphe, sh = scaphal hook, ss = unknown spherical structure. Scale bars: A–C, F–G = 0.1 mm, B (insert), D–E = 0.01 mm.

Chaetigers 1 and 2 with broad anteroventral lobe, with that of chaetiger 1 more prominent. Anterior margin of lobes smooth. Nephridial papillae not observed.

Chaetigers 1–3 (segments 5–7) with notopodia and notochaetae only. Chaetigers 4–16 biramous with notopodia, neuropodia, notochaetae and neurochaetae (Fig. 3C). Chaetiger 17 with notopodia and notochaetae only. All notochaetae finely hirsute, some with smooth tip capillaries and some with broad distal pectinate wing (Fig. 3D). Neuropodia wedge-shaped, erect tori with numerous neurochaetae. Neurochaetal uncini with major teeth arranged in 3–6 longitudinal rows, each row with 6–9 teeth, with size of teeth declining basally (Fig. 3E).

Posterior 5 segments fused to form a flattened plate or scaphe, broader than long, or as broad as long (Fig. 3F). Scaphe with anal flap and dorsal papilla, scaphal margins crenulated and lobed (Fig. 3F–G). Small circular ciliated patches scattered across scaphal lobes, visible only under SEM (Fig. 3G). Scaphal hooks present, 4 pairs, broad, golden or yellow-brown, tips curved and pointed (Figs 2D, 3F).

Remarks. This new species *Amphictene lizardensis* n. sp. is characterized by 4 pairs of robust or broad based scaphal hooks with curved point tips and the arrangement of uncini teeth in 3–6 rows. Hutchings & Peart (2002) provided a summary of the diagnostic feature of all known species of *Amphictene* (see Table 1, Hutchings & Peart 2002) and a new species from the Gulf of Mexico has since been described (García-Garza & de León-González 2014). *Amphictene lizardensis* n. sp. most closely resembles *A. auricoma* (O.F. Müller, 1776) described from Denmark in terms of number of cirri on cephalic veil and on the opercular rim. However, *A. auricoma* has significantly more scaphal hooks (8–18 pairs) than *A. lizardensis* n. sp. (4 pairs). The same character can be used to distinguish *A. lizardensis* n. sp. from the Australian species *A. favona* with 16 pairs of scaphal hooks. *Amphictene uniloba*, the other Australian species, has 4–10 pairs of scaphal hooks, but these are fine, in contrast to the broad based shape with curved pointed tips in *A. lizardensis* n. sp.

Etymology. The species is named after Lizard Island where the species was described from.

Habitat. Shallow subtidal sandy substrates.

Type locality. Queensland: Lizard Island, Watson's Bay, 14°39'26"S, 145°27'3"E.

Distribution. Lizard Island, Queensland.

Genus *Pectinaria* Lamarck, 1818

Pectinaria Savigny in Lamarck, 1818: 348.—Hartman 1941: 329; Hartman 1959: 479; Fauchald 1977: 120; Holthe 1986: 20–21.

Type-species. *Nereis cylindraria belgica* Pallas, 1766, designated by Hartman (1959).

Diagnosis. (After Hutchings & Peart 2002; Nishi *et al.* 2014). Rim of cephalic veil with numerous long cirri. Cephalic veil completely free from operculum, forming a dorsal semi-circular lobe covering the bases of numerous buccal tentacles. Raised opercular margin smooth. Chaetigers 1–3 (segments 5–7) with notopodia and notochaetae only, chaetigers 4–16 biramous with notopodia, neuropodia, notochaetae and neurochaetae, chaetiger 17 with notopodia and notochaetae only (ratio of number of pairs of notopodia to neuropodia 17/13). Notochaetae smooth or serrated (or plumose). Neurochaetal uncini with major teeth arranged in two or three (or more) rows. Posterior 5 segments fused to form a flattened plate or scaphe distinctly separate from the abdomen.

Remarks. Twenty-four species of *Pectinaria* have been described to date. The major Australian revision by Hutchings & Peart (2002) listed 22 species, Nishi *et al.* (2014) re-established *P. hiuchiensis* Kitamori, 1965 and transferred *P. okuda* (Imajima & Hartman, 1964) from the genus *Cistenides*. An additional species is described in this paper.

Pectinaria antipoda Schmarda, 1861

(Fig. 4)

Cistenides antipoda Augener, 1927: 231–234.

Pectinaria antipoda Schmarda, 1861: 46.—Nilsson 1928: 69–73; Not Monro 1931: 28; Knox & Cameron 1971: 34;

Stephenson *et al.* 1974: 114 (in part); Poore *et al.* 1975: 30.

Pectinaria (*Pectinaria*) cf. *antipoda*.—Hartmann-Schröder 1979: 145–146.

Material examined. AM W.43945, MI QLD 2345 (2); AM W.44029, MI QLD 2355; AM W.45037, MI QLD 2441; AM W.45851, MI QLD 2363, photographed.

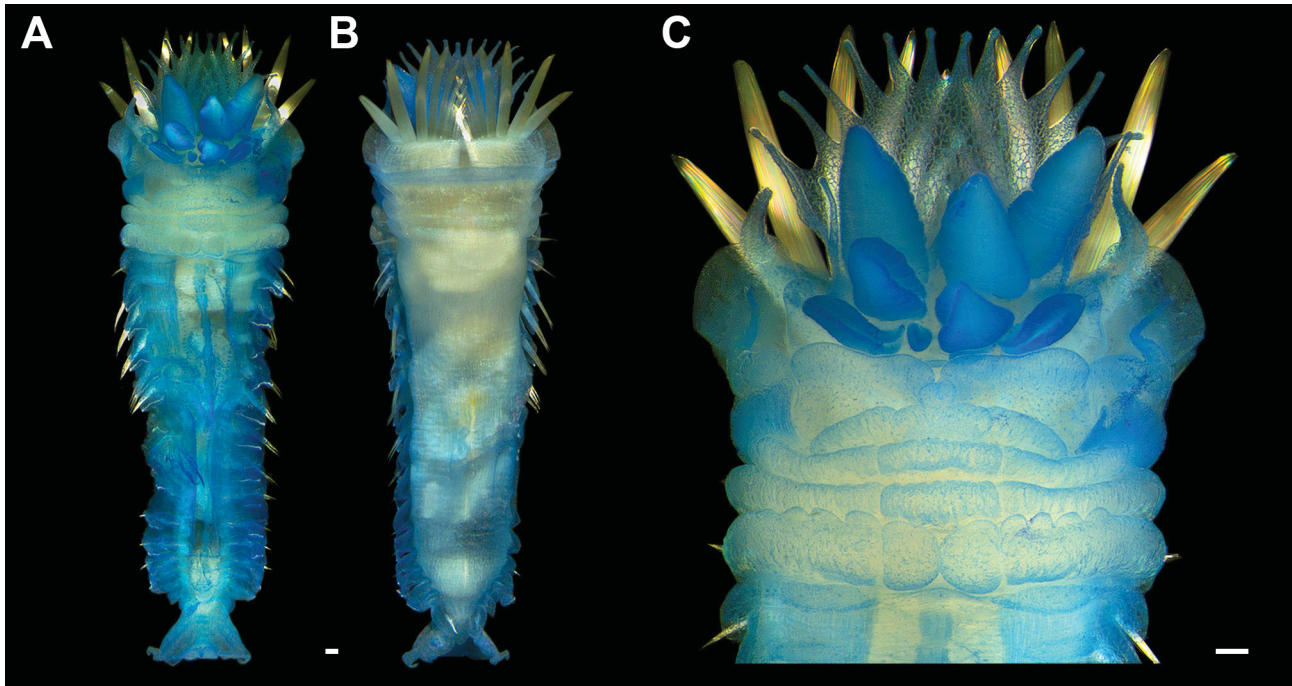


FIGURE 4. *Pectinaria antipoda*, stained with methylene blue, AM W.45851. A. Ventral view of whole animal; B. Dorsal view of whole animal; C. Ventral view of anterior end, anterior margin of chaetiger 2 with large papillae, characteristic of *P. antipoda*. Scale bars: A–C = 0.1 mm.

Remarks. The material collected from Lizard Island was compared with material previously identified as *P. antipoda* and cited in Hutchings & Peart (2002). The species is widely distributed in Australia and has been recorded south from Broome, Western Australia around southern Australia and along the east coast to Heron Island, Queensland. This study extends the known distribution of the species to northern Queensland.

Habitat. The material from Lizard Island was collected from sandy to muddy bottoms at depths of 12–21 m. This species was previously known from low water mark to 92 m, in sediments ranging from mud, silty sand to sand, but has also been reported from *Posidonia* spp. seagrass beds.

Type locality. New South Wales: Port Jackson, Sydney, 33°51'S 151°16'E.

Distribution. Australia: Broome, Western Australia around southern Australia and along the east coast to Lizard Island, Queensland.

***Pectinaria carnosus* n. sp.**

(Figs 5–7)

Material examined. Holotype: AM W.47431, Lizard Island, Coconut Beach, 14°41'3"S 145°28'12"E, intertidal, coll. P. Hutchings & M. Capa, 25 Aug 2010, CReefs, 22.0 mm long, 11.0 mm wide anteriorly, 6.0 mm wide posteriorly.

Description. Preserved specimen pale cream in colour. Body wide, robust and conical in shape (Fig. 5A–B). Anterior width approximately 1/2 length of specimen. Tube straight to slightly curved, composed of cemented shell-like fragments and sand grains.

Rim of cephalic veil with 16 long cirri. Cirri are triangular appendages which rapidly taper. Cephalic veil completely free from operculum, forming a dorsal semi-circle around the numerous buccal tentacles (Fig. 6A). Buccal tentacles numerous and with deep medial groove (Figs 5A, 6A). Raised opercular margin well developed, smooth (Fig. 6B). Operculum with 9 pairs of paleae, yellow-gold, stout, slightly curved dorsally, tips blunt (Fig. 5B). Tentacular cirri not observed. Two pairs of comb-like branchiae on segments 3 and 4, situated laterally and consisting of loose flat lamellae. Anterior pair larger and situated more ventrally than posterior pair.

Chaetiger 1 and 2 with anteroventral lobe large and broad, with that of chaetiger 2 larger than that of chaetiger 1; anterior margin of lobes smooth. Nephridial papillae not observed.

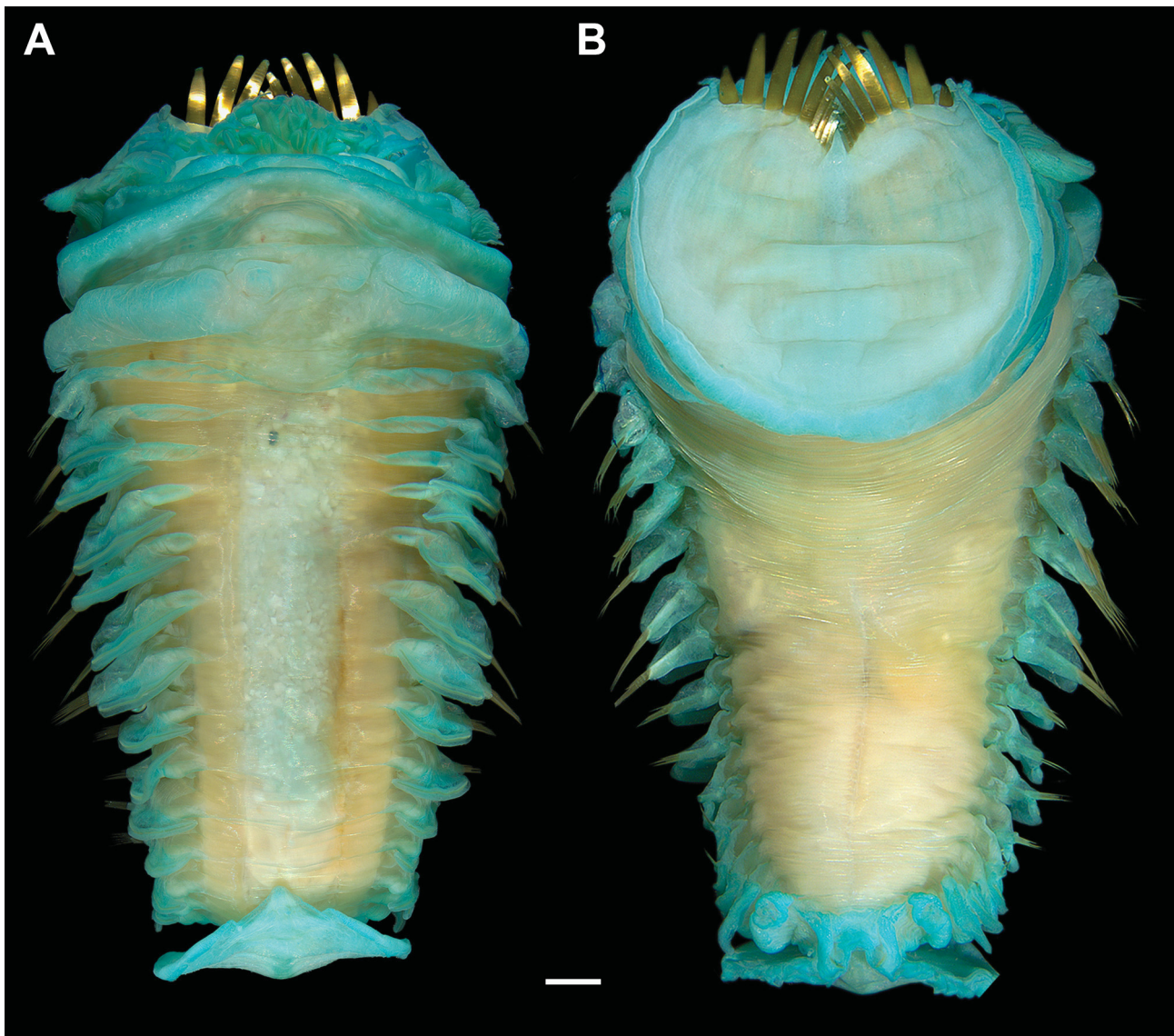


FIGURE 5. *Pectinaria carnosus* n. sp., stained with methyl green, holotype, AM W.47431. A. Ventral view of entire animal; B. Dorsal view of entire animal. Scale bar: A–B = 1 mm.

Chaetigers 1–3 (segments 5–7) with notopodia and notochaetae only. Chaetigers 4–16 biramous with notopodia, neuropodia, notochaetae and neurochaetae. Chaetiger 17 with only notopodia and notochaetae.

Notochaetae of chaetigers 1–3 and 12–17 reduced in size compared to those of notopodia 4–11. Notochaetae include smooth winged capillaries and thick robust chaetae (Fig. 7A–B). Neuropodia wedge shaped, erect and glandular. Neurochaetae with major teeth arranged in 2 rows, 6–10 teeth per row (Fig. 7C). Glandular areas present on chaetigers 3–17. Glandular areas from chaetigers 3–8 form prominent strips that are partially joined to anterior edge of corresponding neuropodia (Fig. 6B).

Posterior scaphe and abdomen distinctly separated. Posterior 5 segments fused to form a flattened plate or scaphe, broader than long, with crenulated margins (Fig. 6C–D). Anal flap present. Scaphal hooks present, 6 pairs, broad, blunt, golden (Fig. 6C).

Remarks. This new species *Pectinaria carnosus* n. sp. is characterised by 9 pairs of stout paleae with blunt tips and 6 pairs of broad and blunt scaphal hooks. Hutchings & Peart (2002) provided a summary of the diagnostic feature of all known species (see Table 4) together with comments on the validity of the type species of the genus. *Pectinaria carnosus* n. sp. most closely resembles *P. belgica* Hutchings & Peart, 2002 (described from Sweden), *P. antipoda* and *P. dodeka*.

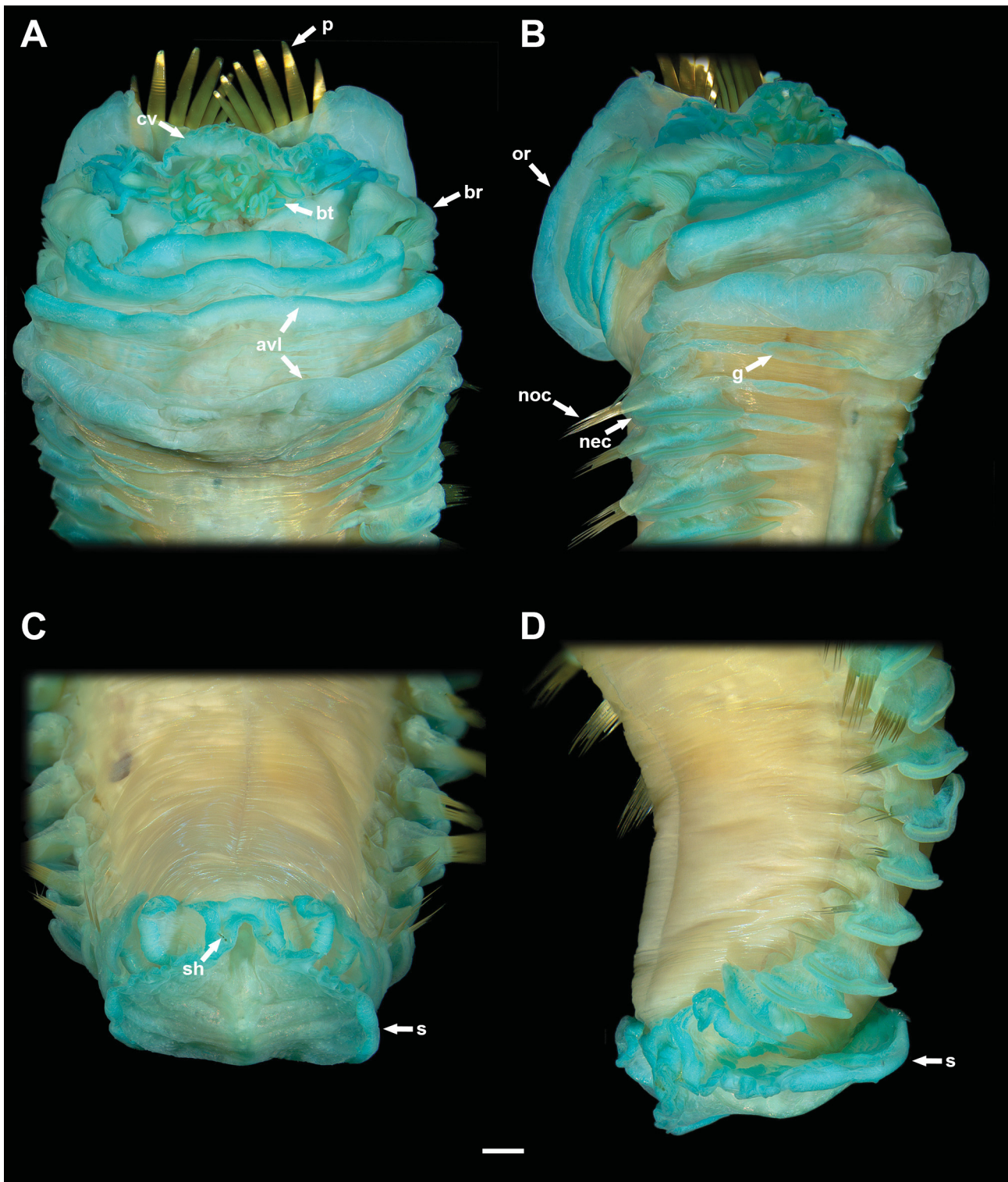


FIGURE 6. *Pectinaria carnosus* n. sp., stained with methyl green, holotype, AM W.47431. A. Ventral view of anterior end; B. Lateral view of anterior end; C. Posterior end; D. Lateral view of last chaetigers. Abbreviations: avl = anteroventral lobes, br = branchiae, bt = buccal tentacles, cv = cephalic veil, g = glandular area, nec = neurochaetae, noc = notochaetae, or = opercular rim, p = paleae, s = scaphe, sh = scaphal hooks. Scale bar: A–D = 1 mm.

Pectinaria carnosus n. sp. can be distinguished from *P. antipoda* by the absence of large rounded papillae on the anteroventral lobe of chaetiger 2, which varies from 12 to 19 in *P. antipoda*. *Pectinaria carnosus* n. sp. can also be distinguished from the only other Australian species *P. dodeka* and *P. kanabinos* by the shape of paleae.

Pectinaria carnosus n. sp. has short stout paleae with blunt tips, as opposed to the acute and needle-like shape in *P. dodeka* and *P. kanabinos*.

Etymology. The species name *carnosus* translates as “fleshy” in Latin and is representative of the general shape of the specimen.

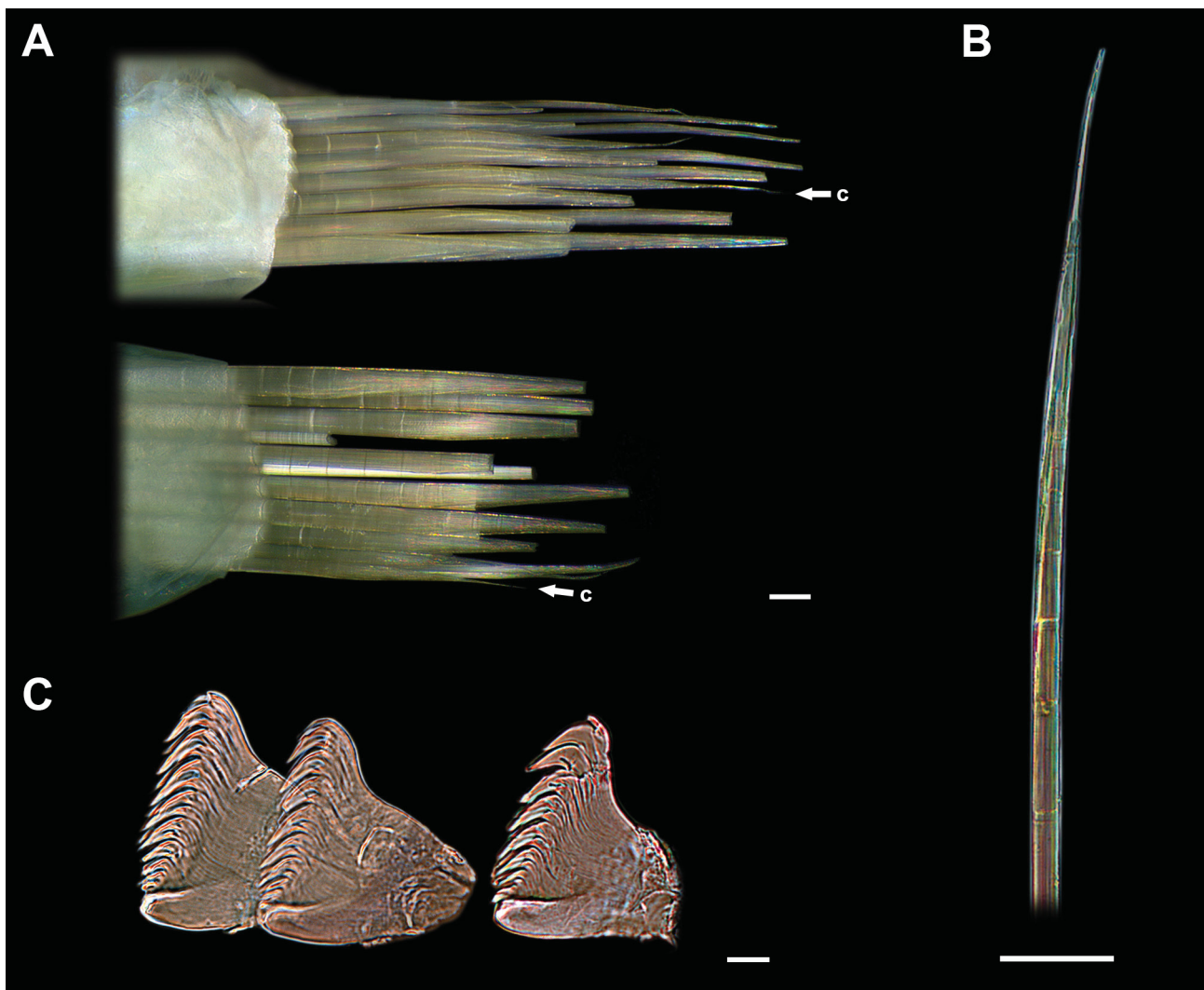


FIGURE 7. Chaetae of *Pectinaria carnosus* n. sp., holotype, AM W.47431. A. Notochaetae of chaetiger 1 (above) and chaetiger 6 (below), both with robust chaetae and smooth winged capillaries; B. smooth winged capillary from notochaetae of chaetiger 5 as viewed under a compound microscope; C. Neurochaetal uncini of chaetiger 5, main teeth arranged in 2 rows. Abbreviations: c = smooth winged capillaries. Scale bars: A–B = 0.1 mm, C = 0.01 mm.

Habitat. Found in amongst coral rubble.

Type locality. Queensland: Lizard Island, Coconut Beach, 14°41'3"S 145°28'12"E.

Distribution. Species currently known only from Lizard Island in the intertidal zone.

Discussion

This study has documented the first record of this distinctive family in the Lizard Island region, although it is not common. Intensive polychaete collecting for 8 weeks during the 2010 CReefs survey and for 12 days during the 2013 Polychaete Workshop collected only the nine specimens mentioned here within.

A comprehensive study of the entire family is needed and many of the diagnostic characters need to be better illustrated using SEM. We also suspect that some widely distributed species should be re-examined using a

combination of molecular and morphological data which may reveal cryptic species. For some current species there appears to be considerable variation in counts of currently accepted diagnostic characters such as number of paleae and number of cirri on cephalic veil and opercular rim. These characters need to be more carefully examined and perhaps related to size of individual. Descriptions of character variations from juvenile and sub-adult specimens should ideally be avoided. The two new species described here are likely adults, at least for *Amphictene lizardensis* n. sp., due to the presence of coelomic gametes.

We describe a balloon like structure between the two sets of paleae in *Amphictene lizardensis* n. sp. (Figs 2B, 3A); however we have little idea as to its function or if it is present in other species in the genus. Although we know it is absent in other Australian species of this genus, we can find no mention of this structure in any other literature on the family. We suggest it may be a sensory structure but a detailed histological investigation would need to be undertaken. The small circular patches observed scattered across scaphal lobes of the same species may be cilia or bacteria accumulating in pits, however the function of these is unknown, and whether they are universally found or just restricted to this species.

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